ABRIDGED DATA SHEET

ANALOG DEVICES

Ultra-Low Power, 4-Channel Biopotential and Bioimpedance AFE

MAX30011

General Description

The MAX30011 is a highly integrated, four-channel biopotential analog front end (AFE) for wearable applications, offering both clinical-grade performance and ultra-low power for long battery life.

Each of the four biopotential channels has EMI filtering, internal lead biasing, and extensive calibration voltages for built-in self test. Each biopotential channel also has high input impedance, low noise, high CMRR, programmable gain, an anti-aliasing low-pass filter, and a high-resolution ADC. A set of high-pass and low-pass digital filter options are also available. Further, the MAX30011 provides an active right leg drive (RLD) circuit, pacemaker edge and pulse detection, and a single bioimpedance channel capable of measuring respiration and other BioZ measurements, including the characterization of electrode-tissue interface (ETI) impedances. The device is designed to meet IEC 60601-2-47 Ambulatory ECG System compliance requirements and IEC 60601-2-27 Monitoring ECG System compliance requirements for pace detection.

The BioZ receive channel has EMI filtering and extensive calibration features. It also has high input impedance, low noise, programmable gain, low-pass and high-pass filter options, and a high-resolution ADC. There are several modes for generating stimulus: balanced square-wave source/sink current, sine-wave current, and both sine-wave and square-wave voltage. A balanced square-wave source/sink current generator is provided for simultaneous operation with the electrocardiogram (ECG) channel. A wide range of stimulus frequencies is supported.

The MAX30011 can also easily be implemented as two or more parallel devices for higher lead count ECG and electroencephalogram (EEG) applications. Due to its low-noise, high input impedance, very low input-referred voltage and current noise characteristics, the device also works well for dry electrode applications such as smart clothing. The MAX30011 has DC (electrode) lead-off detection as well as AC lead quality test capability, and a flexible timing system with internal oscillators and a PLL. It is available in an 8x8 64-bump, 3.57mm x 3.57mm, 0.4mm pitch wafer-level package (WLP) and operates over a -40ºC to +85ºC temperature range.

Applications

- Wearable Patient Monitors
- Holter Monitors and Telemetry Systems
- Multichannel ECG and EEG Wearable Devices
- Ambulatory Cardiac Monitoring Patches
- Smart Clothing

Benefits and Features

Biopotential Channel

- Clinical Grade Biopotential Acquisition System
  - 0.5µV_{RMS} (0.05Hz to 40Hz) in Low-Power Mode, 250SPS
  - 0.31µV_{RMS} (0.05Hz to 150Hz) in Low-Noise Mode, 2kSPS
  - < 5 f$A_{RMS}/\sqrt{Hz}$ Input Current Noise (25°C)
- CMRR 114dB Typical at 50Hz and 60Hz
- High Input Impedance (1GΩ Typical) for Extremely Low Common to Differential Mode Conversion
- High DC Offset Range (±1000mV) Allows a Wide Variety of Electrodes to be Used
- High AC Dynamic Range of 200mV_{PP} Prevents Saturation Due to Motion
- Low Power Pacemaker Pulse Detection

BioZ

- High Performance BioZ Data Acquisition System
- Low-Noise BioZ Receive Channel (1.03µV_{RMS})
- 50m$Ω_{PP}$ Noise in Respiration Mode, 2.5Hz Bandwidth
- Balanced, Chopped Source and Sink Current Stimulus; 10kHz to 131kHz
- BIA/BIS with Absolute Resistance and Reactance Accuracy, 16Hz to 500kHz
- Electrode-Tissue Interface Impedance Characterization

System

- Ultra-Low Power Systems for Wearable Devices
- DC and AC Leads Off Detect Capability
- Shutdown Current of 1µA (typ)
- 1024-Word FIFO for ECG and BioZ and Pace Data
- Flexible Interrupt and Synchronization Capabilities

***Ordering Information* appears at end of data sheet.**

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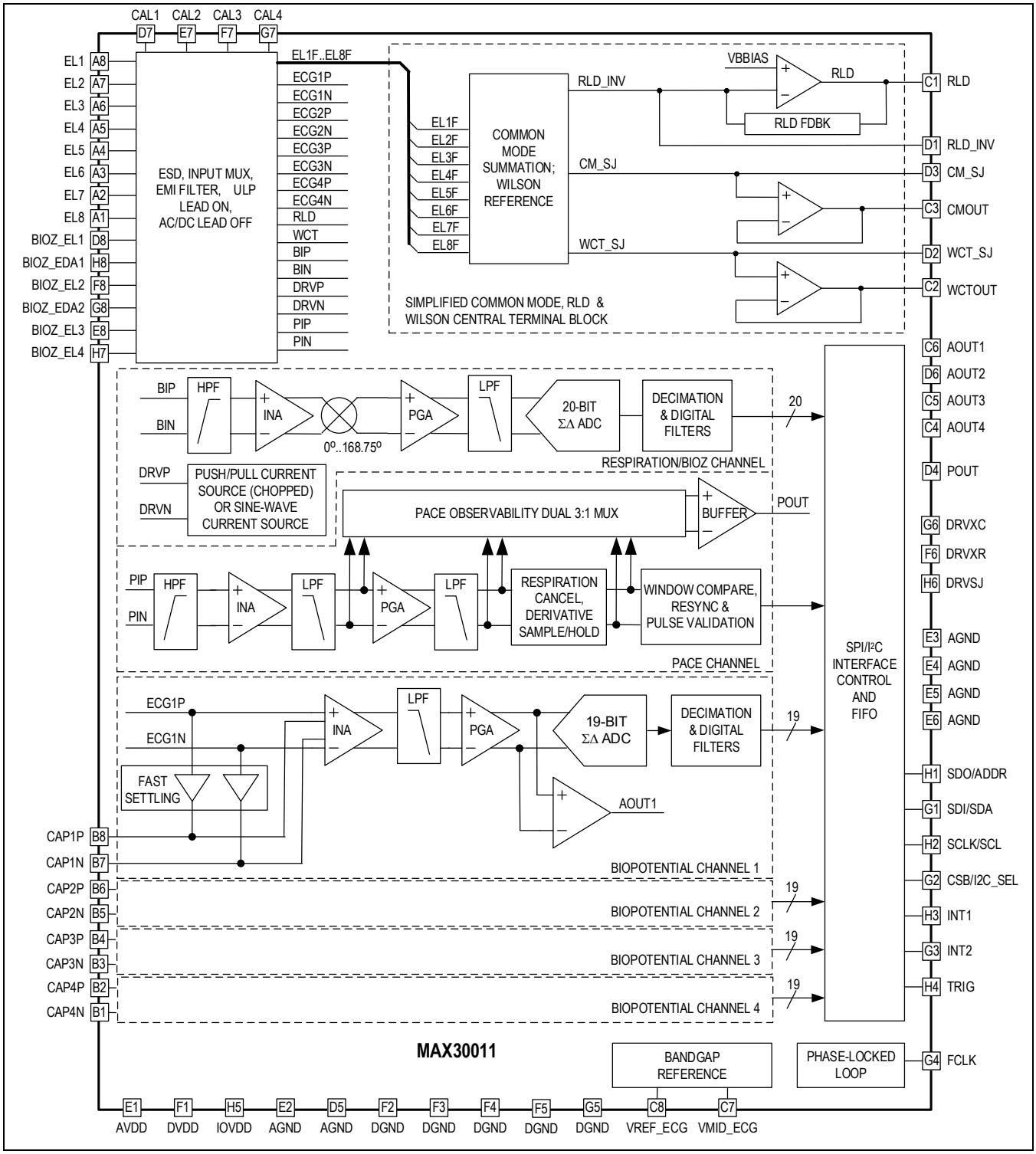
Simplified Block Diagram



Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	5/26	Initial release	—